Application No.: 10/054,241
Supplemental Response

Attorney Docket No.: EMC2-078AUS

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claims 1-10 (cancelled)

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11. (previously presented) A data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such interface, comprising:

a memory;

a plurality of directors, at least one front-end one of the directors being in communication with the host computer and at least one rear-end one of the directors being in communication with the bank of disk drives, each one of the directors comprising:

a central processing unit;

an interface state data bus section, for carrying interface state data, such interface state data bus section being in communication with both:

(a) the at least one front-end one and the at least one rear-end one of the directors; and

(b) the memory;

a plurality of end-user data busses, for carrying end-user data, each one of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of directors and a second end coupled to the memory; and

wherein the central processing units of such plurality of directors control the end-user data transfer between the host computer and the bank of disk drives through the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors via the interface state data bus section.

12. (previously presented) The system recited in claim 11 wherein the end-users data busses are serial busses.

13. (previously presented)The system recited in claim 11 wherein the interface state data bus section includes parallel busses.

14. (previously presented)The system recited in claim 13 wherein the parallel busses are coupled to the directors in a multi-drop configuration.

15. (previously presented)The system recited in claim 13 wherein the end-user data busses are serial busses.

16. (previously presented)The system recited in claim 15 wherein the parallel busses are coupled to the directors in a multi-drop configuration.

17. (presently amended)The system recited in claim 11 including a coupling node and wherein each the memory has a plurality of regions and wherein the each one of the end-user data buses is coupled to the plurality of regions selectively through the coupling node.

18. (previously presented)The system recited in claim 17 wherein the coupling node includes a cross-bar switch.

19. (presently amended) The system recited in claim 13 wherein the interface state data bus section includes a plurality of parallel busses, each one thereof being coupled to a one of the plurality of directors and to the memory.

20. (previously presented) A method of operating a data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such method comprising:

providing a memory;

providing a plurality of directors, each one of the directors having a central processing unit, at least one front-end one of the directors being in communication with the host computer and at least one rear-end one of the directors being in communication with the bank of disk drives;

providing a plurality of interface state data busses for carrying interface state data, such interface state data busses being in communication with both:

(a) the at least one front-end one and the at least one rear-end one of the directors; and

(b) the memory;

providing a plurality of end-user data busses, for carrying end-user data, each one of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of directors and a second end coupled to the memory; and

wherein the central processing units of such plurality of directors control the end-user data transfer between the host computer and the bank of disk drives through the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors via the interface state data bus.

21. (previously presented) A data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such interface, comprising:

a memory;

a plurality of directors, each one having a central processing unit, at least one front-end one of the directors being in communication with the host computer and at least one rear-end one of the directors being in communication with the bank of disk drives;

an interface state data bus section, for carrying interface state data, such interface state data bus section being in communication with the at least one front-end one and the at least one rear-end one of the directors;

a plurality of end-user data busses, for carrying end-user data, each one of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of directors and a second end coupled to the memory; and

wherein such central processing units of the plurality of directors control the end-user data transfer between the host computer and the bank of disk drives via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors via the interface state data bus section.

22. (previously presented)The system recited in claim 21 wherein the end-users data busses are serial busses.

23. (previously presented)The system recited in claim 21 wherein the interface state data bus section includes parallel busses.

24. (previously presented)The system recited in claim 23 wherein the parallel busses are coupled to the directors in a multi-drop configuration.

25. (previously presented)The system recited in claim 23 wherein the end-user data busses are serial busses.

26. (previously presented)The system recited in claim 25 wherein the parallel busses are coupled to the directors in a multi-drop configuration.

27. (presently amended) The system recited in claim 21 including a coupling node and wherein each the memory has a plurality of regions and wherein the each one of the end-user data buses is coupled to the plurality of regions selectively through the coupling node.

28. (presently amended) The system recited in claim 23 wherein the interface state data bus section includes a plurality of parallel busses, each one thereof being coupled to a one of the plurality of directors and to the memory.

29. (currently amended) A method of operating a data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such method comprising:

providing a memory;

providing a plurality of directors each one of the directors having a central processing unit, at least one front-end one of the directors being in communication with the host computer and at least one rear-end one of the directors being in communication with the bank of disk drives;

providing an interface state data section for carrying interface state data, such interface state data section being in communication with the at least one front-end one and the at least one rear-end one of the directors;

providing a plurality of end-user data busses, for carrying end-user data, each one of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of directors and a second end coupled to the memory; and

wherein such central processing units of the plurality of directors control the end-user data transfer between the host computer and the bank of disk drives and the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors.

30. (previously presented) A data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such interface, comprising:

a memory;

a plurality of directors, each one thereof having a central processing unit, a front-end portion of such plurality of directors being in communication with the host computer, and a rear end portion of such plurality of directors being in communication with the bank of disk drives;

an interface state data bus section, for carrying interface state data, such interface state data bus section being in communication with both the front-end portion of the plurality of directors and the rear end portion of the plurality of directors;

a plurality of end-user data busses, for carrying end-user data, each one of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of directors and a second end coupled to the memory; and

wherein the central processing units of such plurality of directors control the end-user data transfer between the host computer and the bank of disk drives through the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors.

31. (previously presented) The system recited in claim 30 wherein the end-users data busses are serial busses.

32. (previously presented) The system recited in claim 30 wherein the interface state data bus section includes parallel busses.

33. (previously presented) The system recited in claim 32 wherein the parallel busses are coupled to the directors in a multi-drop configuration.

34. (previously presented) The system recited in claim 32 wherein the end-user data busses are serial busses.

35. (previously presented) The system recited in claim 34 wherein the parallel busses are coupled to the directors in a multi-drop configuration.

36. (presently amended) The system recited in claim 30 including a coupling node and wherein each the memory has a plurality of regions and wherein the each one of the end-user data buses is coupled to the plurality of regions selectively through the coupling node.

37. (previously presented) The system recited in claim 36 wherein the coupling node includes a cross-bar switch.

38. (presently amended) The system recited in claim 32 wherein the interface state data bus section includes a plurality of parallel busses, each one thereof being coupled to a one of the plurality of directors and to the memory.

39. (previously amended) A method of operating a data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such method comprising:

providing a memory;

providing a plurality of directors, each one of the directors having a central processing unit, a front end portion of the directors being in communication with the host computer and a rear end portion of the directors being in communication with the bank of disk drives;

providing an interface state data section for carrying interface state data, such interface state data section being in communication with the front end portion of the directors and the rear end portion of the directors;

providing a plurality of end-user data busses, for carrying end-user data, each one of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of directors and a second end coupled to the memory; and

wherein the central processing units of such plurality of directors control the end-user data transfer between the host computer and the bank of disk drives and the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors.

40. (presently amended) A data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such interface, comprising:

a memory;

a plurality of directors, comprising:

a plurality of front-end directors, each one of such front-end ~~direcytors~~directors having a central processing unit, such plurality of front end directors being in communication with the host computer, and

a plurality of rear end directors, each one of the rear-end directors having a central processing unit, such plurality of rear end directors being in communication with the bank of disk drives;

an interface state data bus section, for carrying interface state data, such interface state data bus section being in communication with both the front-end portion of the plurality of directors and the rear end portion of the plurality of directors;

a plurality of end-user data busses, for carrying end-user data, each one of a first portion of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of front end directors and a second end coupled to the memory and each one of a second portion of the plurality of end user data buses having a first end coupled to a

corresponding one of the plurality of rear end directors and a second end coupled to the memory; and

wherein the central processing units of such plurality of directors control the end-user data transfer between the host computer and the bank of disk drives through the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors.

41. (previously presented) The system recited in claim 40 wherein the first portion of the end-users data busses comprises a plurality of serial busses.

42. (previously presented) The system recited in claim 40 wherein the second portion of the interface state data bus section comprises a plurality of serial busses.

43. (previously presented) The system recited in claim 42 wherein the first portion of the end-users data busses comprises a plurality of serial busses.

44. (previously amended) A method of operating a data storage system wherein end-user data is transferred between a host computer and a bank of disk drives through an interface, such method comprising:

providing a memory;

providing a plurality of directors, such plurality of directors comprising:

a plurality of front end directors, each one thereof having a central processing unit, such plurality of front end directors being in communication with the host computer, and;

a plurality of rear end directors, each one thereof having a central processing unit, such plurality of rear end directors being in communication with the bank of disk drives;

providing an interface state data section for carrying interface state data, such interface state data section being in communication with the plurality of front end directors and the plurality of rear end directors;

providing a plurality of end-user data busses, for carrying end-user data, each one of a first portion of the plurality of end-user data busses having a first end coupled to a corresponding one of the plurality of front end directors and a second end coupled to the memory and each one of a second portion of the plurality of end user buses having a first end coupled to a corresponding one of the plurality of the rear end directors and a second end coupled to the memory;

wherein the central processing units of such plurality of directors control the end-user data transfer between the host computer and the bank of disk drives and the memory via the end-user data busses in response to interface state data generated by the directors, such generated interface state data being transferred among the directors.

45. (previously presented) The method recited in claim 44 wherein the first portion of the end-users data busses is provided with a plurality of serial busses.

46. (previously presented) The method recited in claim 44 wherein the second portion of the interface state data bus section is provided with a plurality of serial busses.

47. (presently amended) The method recited in claim 46 wherein the first portion of the end-users data busses is provided with a plurality of serial busses.

48. (previously presented) (previously presented) A system, comprising:

a plurality of directors, each one of the directors having:

a plurality of ~~n~~ end user data ports and ~~an~~ interface state data port; and

a crossbar switch having a plurality of first ports and a plurality of second ports, each one of the crossbar switch first ports being coupled to a corresponding one of the plurality of end user data ports;

a cache memory having a plurality of memory sections;

wherein each one of the crossbar switch second ports is coupled to a corresponding one of the plurality of memory sections ~~coupled to the end-user data ports of the plurality of directors~~;

wherein the directors control end user data transfer with end user data in such end user data transfer passing through the cache memory in response to interface state data passing through the interface state data ports of the directors.

49. (presently amended) A data storage system for transferring data between a host computer/server and a bank of disk drives through a system interface, such system interface comprising:

a plurality of first directors coupled to host computer/server, each one of the first directors having:

~~a an~~ plurality of end user data ports and an interface state data port; and

a crossbar switch having a plurality of first ports and a plurality of second ports, each one of the crossbar switch first ports being coupled to a corresponding one of the plurality of end user data ports;

a plurality of second directors coupled to the bank of disk drives, each one of the second directors having:

~~an~~ a plurality of end user data port and an interface state data port; and

a plurality of end user data ports and a interface state data port; and

a crossbar switch having a plurality of first ports and a plurality of second ports, each one of the crossbar switch first ports being coupled to a corresponding one of the plurality of end user data ports;

a cache memory having a plurality of memory sections;

wherein each one of the crossbar switch second ports of the first and second directors being is coupled to a corresponding one of the plurality of memory sections~~coupled to the end user data ports of the plurality of first directors and second directors~~;

wherein the first and second directors control end user data transfer between the host computer and the bank of disk drives with end user data in such end user data transfer passing through the cache memory in response to interface state data passing between the first director and the second director through the interface state data ports of the plurality of first directors and the plurality of second directors.

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50. (presently amended) A system, comprising:

a plurality of directors, each one of the directors having:

a plurality of ~~a~~ end user data ports and an interface state data port and

a crossbar switch having a plurality of first ports and a plurality of second ports, each one of the crossbar switch first ports being coupled to a corresponding one of the plurality of end user data ports;

;

a cache memory having a plurality of memory sections;

wherein each one of the crossbar switch second ports of the first and second directors being coupled to is coupled to a corresponding one of the plurality of memory sections;

wherein the directors control end user data transfer with end user data in such end user data transfer passing to the cache memory through the end user data ports in response to interface state data passing through the interface state data ports of the directors.

51. (presently amended) A data storage system for transferring data between a host computer/server and a bank of disk drives through a system interface, such system interface comprising:

a plurality of first directors coupled to host computer/server, each one of the first directors having: ~~an~~ a plurality of end user data ports, ~~and~~ an interface state data port and a crossbar switch having a plurality of first ports and a plurality of second ports, each one of the crossbar switch first ports being coupled to a corresponding one of the plurality of end user data ports;;

a plurality of second directors coupled to the bank of disk drives, each one of the second directors having: ~~an~~ a plurality of end user data ports; ~~and~~ an interface state data port; and a crossbar switch having a plurality of first ports and a plurality of second ports, each one of the crossbar switch first ports being coupled to a corresponding one of the plurality of end user data ports;

a cache memory having a plurality of memory sections;

wh rein each one of the crossbar switch second ports of the first and second directors being is coupled to a corresponding one of the plurality of memory sections; and

wherein the first and second directors control end user data transfer between the host computer and the bank of disk drives with end user data in such end user data transfer passing through the end user data ports in response to interface state data passing between the first director and the second director through the interface state data ports of the plurality of first directors and the plurality of second directors.

52 (presently amended) A system, comprising:

a plurality of directors, each one having a crossbar switch , such crossbar switch having a plurality of ports;

a cache memory having a plurality of memory sections in communication with the plurality of directors;

wherein each one of the plurality of crossbar switch ports of each one of the plurality of directors is coupled to a corresponding one of the plurality of memory sections; and

wherein the directors control end user data transfer with end user data in such data transfer passing to the cache memory through an end user data communication channel in response to interface state data passing through the directors through a different, interface state data communication channel.

53 (presently amended) A data storage system for transferring data between a host computer/server and a bank of disk drives through a system interface, such system interface comprising:

a plurality of first directors coupled to host computer/server;

a plurality of second directors coupled to the bank of disk drives;

a cache memory in communication with the plurality of directors, such memory having memory having a plurality of memory sections;

wherein each one of the plurality of crossbar switch ports of each one of the plurality of directors is coupled to a corresponding one of the plurality of memory sections; and

wherein the first and second directors control end user data transfer between the host computer and the bank of disk drives with end user data in such end user data transfer passing through an end user communication channel in response to interface state data passing between the first director and the second director through a different, interface state data communication path.

54. (presently amended) A system, comprising:

a plurality of directors, each one of the directors having an end user data port and an interface state data port, one of such ports being coupled to a crossbar switch;

a cache memory coupled to the end user data ports of the plurality of directors;

wherein the directors control end user data transfer with end user data in such end user data transfer passing through the cache memory in response to interface state data passing through the interface state data ports of the directors, such interface state data passing through a different channel than a channel used to pass the end user data.

55. (presently amended) A data storage system for transferring data between a host computer/server and a bank of disk drives through a system interface, such system interface comprising:

a plurality of first directors coupled to host computer/server, each one of the first directors having an end user data port and an interface state data port; one of such ports being coupled to a crossbar switch

a plurality of second directors coupled to the bank of disk drives, each one of the second directors having an end user data port and an interface state data port, one of such ports being coupled to a crossbar switch;

a cache memory coupled to the end user data ports of the plurality of first directors and second directors;

wherein the first and second directors control end user data transfer between the host computer and the bank of disk drives with end user data in such end user data transfer passing through the cache memory in response to interface state data passing between the first director and the second director through the interface state data ports of the plurality of first directors and the plurality of second directors, such interface state data passing through a different channel than a channel used to pass the end user data.

56. (presently amended) A system, comprising:

a plurality of directors, each one of the directors having a n end user data port and an interface state data port, one of such ports being coupled to a crossbar switch;

a cache memory ;

wherein the directors control end user data transfer with end user data in such end user data transfer passing to the cache memory through the end user data ports in response to interface state data passing through the interface state data ports of the directors, such interface state data passing through a different channel than a channel used to pass the end user data.

57. (presently amended) A data storage system for transferring data between a host computer/server and a bank of disk drives through a system interface, such system interface comprising:

a plurality of first directors coupled to host computer/server, each one of the first directors having an end user data port and an interface state data port, one of such ports being coupled to a crossbar switch;

a plurality of second directors coupled to the bank of disk drives, each one of the second directors having an end user data port and an interface state data port, one of such ports being coupled to a crossbar switch;

a cache memory;

wherein the first and second directors control end user data transfer between the host computer and the bank of disk drives with end user data in such end user data transfer passing through the end user data ports in response to interface state data passing between the first director and the second director through the interface state data ports of the plurality of first directors and the plurality of second directors, such interface state data passing through a different channel than a channel used to pass the end user data.

58. (previously presented) A system, comprising:

a plurality of directors;

a cache memory in communication with the plurality of directors,

wherein the directors control end user data transfer with end user data in such data transfer passing to the cache memory through an end user data communication channel in response to interface state data passing through the directors through a different, interface state data communication channel, one of such channels being coupled to a crossbar switch.

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59. (previously presented) A data storage system for transferring data between a host computer/server and a bank of disk drives through a system interface, such system interface comprising:

a plurality of first directors coupled to host computer/server;

a plurality of second directors coupled to the bank of disk drives;

a cache memory in communication with the plurality of directors,

wherein the first and second directors control end user data transfer between the host computer and the bank of disk drives with end user data in such end user data transfer passing through an end user communication channel in response to interface state data passing between the first director and the second director through a different, interface state data communication channel one of such channels being coupled to a crossbar switch.